Global Hydrology Resource Center

Data User Guide

GPM Ground Validation Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR) IPHEx

Introduction

The GPM Ground Validation Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR) IPHEx dataset contains rainfall rate measurements derived using the SCaMPR algorithm to combine GOES infrared (IR) data and derived parameters as inputs. The SCaMPR algorithm is calibrated using microwave rainfall estimates from the Special Sensor Microwave/Imager (SSM/I) and Advanced Microwave Sounding Unit (AMSU). This dataset contains the values for the time period of the IPHEx campaign from April 30, 2015 to June 17, 2015. The IPHEx campaign was designed to characterize warm season orographic precipitation regimes and determine the relationship between precipitation regimes and hydrologic processes in regions of complex terrain. These data are available in netCDF-4 format, while browse images are available in GIF format.

Citation

Kuligowski, Robert. 2017. GPM Ground Validation Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR) IPHEx [indicate subset used]. Dataset available online from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/GPMGV/IPHEX/SCAMPR/DATA301

Keywords:

NASA, GHRC, North Carolina, IPHEx, SCaMPR, rainfall rate

Campaign

The GPM Ground Validation campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after launch on the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint-agency/international external field campaigns, using state of the art

cloud and precipitation observational infrastructure. These field campaigns accounted for the majority of the effort and resources expended by the GPM Ground Validation mission. More information about the GPM Ground Validation mission is available at https://pmm.nasa.gov/index.php?q=science/ground-validation.

One of the GPM Ground Validation field campaigns was the Integrated Precipitation and Hydrology Experiment (IPHEx), which was held in North Carolina during 2014 with an intense study period from May 1 to June 15, 2014. The goals of the IPHEx field campaign were to characterize warm season orographic precipitation regimes and hydrologic processes in regions of complex terrain, to contribute to the development, evaluation, and improvement of remote sensing precipitation algorithms in support of the GPM mission, and to evaluate Quantitative Precipitation Estimation (QPE) products for hydrological forecasting and water resource applications in the Upper Tennessee, Catawba-Santee, Yadkin-Pee Dee, and Savannah river basins (IPHEX-HAP, H4SE) in conjunction with the NOAA Hydrometeorology Testbed project. More information about IPHEx is available at http://gpm.nsstc.nasa.gov/iphex/.

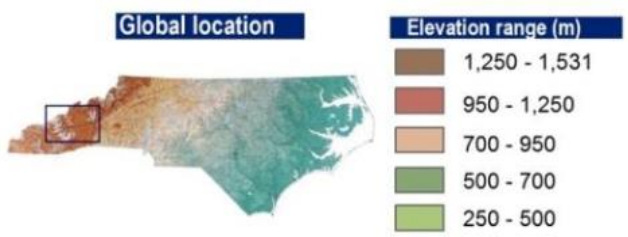

Figure 1: Region of North Carolina IPHEx campaign ground validation (image source: http://gpm-gv.gsfc.nasa.gov/Gauge/)

Product Description

The Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR) algorithm was developed to combine the the relative strengths of infrared-based and microwave-based precipitation estimates. Infrared (IR) data from GOES IR are used as input as these data have high spatial (4 km) and temporal (minutes) resolutions with a low latency, however rain-producing clouds are opaque for IR wavelengths and information about rain is inferred from cloud-top properties. Microwave data are used, despite the lower spatial (20-30 km) and temporal (2 times / day) resolutions, because microwave radiances are sensitive to the amount of hydrometeors (water and ice) within a cloud.

This SCaMPR data product uses GOES infrared data, band 3 (6.7 microns) brightness temperature, band 4 (10.7 microns) brightness temperatures and the difference between the two bands as predictor information and calibrates them against the microwave-based rain rates from the Climate Prediction Center (CPC) combined microwave (MWCOMB) data product optimizing the accuracy of the output. The MWCOMB product contains daily composites of all available passive microwave precipitation estimates from SSM/I, AMSU-B and TMI (TRMM). Calibrations of the SCaMPR algorithm are performed for both rain/no

rain separation (using discriminant analysis) and rainfall rate (using multiple linear regression).

Investigators

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Data Characteristics

The GPM Ground Validation Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR) IPHEx data files are available in netCDF-4 format at Level 1B processing level. The data have been cropped from the larger SCaMPR product to the eastern half of U.S. to narrow the dataset to the space and time of the IPHEx campaign. Corresponding browse images of rainfall rate plots are also available in GIF format. More information about the NASA data processing levels are available on the NASA Data Processing Levels website.

Table 1: Data Characteristics

Characteristic	Description
Platform	Various GOES geostationary platforms, various DMSP platforms
Instruments	GOES, SSM/I, SSMIS data used as input to algorithm
Algorithm	Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR)
Projection	n/a
Spatial Coverage	N: 42.921, S: 27.897, E: -71.798, W: -91.741 (North Carolina)
Spatial Resolution	4 km
Temporal Coverage	April 30, 2015 - June 17, 2015
Temporal Resolution	~15 minutes
Sampling Frequency	minutes
Parameter	Rainfall rate
Version	1
Processing Level	4

File Naming Convention

The GPM Ground Validation Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR) IPHEx dataset consists of netCDF-4 data files containing 1-hr or 6-hr estimated rainfall rates , as well as corresponding GIF browse images for viewing the data. These data and browse image files are in the following naming convention as shown below.

Data files: iphex_scampr_YYYYMMDD_hhmm.nc
Browse files: iphex_scampr_YYYYMMDDhhmm.[1H|6H].gif

Table 2: File naming convention variables

Variable	Description

YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
.nc	netCDF-4 format
[1H|6H]	1H = 1 hour rainfall rate estimate map 6H = 6 hour rainfall rate estimate map
.gif	Graphics Interchange Format

Data Format and Parameters

The GPM Ground Validation Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR) IPHEx consists of netCDF-4 data files, as well as associated GIF browse files of rain rate measurements. The data files contain rainfall rate data, location of measurements, and time information. Table 3 describes the data files within the netCDF-4 data files.

Table 3: Data Fields

Field Name	Description	Data Type	Unit
latitude	Latitude of the observation	float	Degrees North
longitude	Longitude of the observation	float	Degrees East
rainfall_rate	Rainfall rate	float	mm/hr
time	Time of 1-hr or 6-hr map image	int	Seconds since 2014-05-01 00:15:00Z

Algorithm

This data product was created using the SCaMPR algorithm with GOES IR data calibrated against MWCOMB microwave rain data. More information about the SCaMPR algorithm is available in Kuligowski, 2002 with a brief summary on the STAR Satellite Rainfall Estimates SCaMPR web page.

Quality Assessment

The SCaMPR algorithm is called self-calibrating as it routinely updates the relationship between the GOES infrared brightness temperatures and rainfall estimates and the MWCOMB rainfall estimates updating the calibration every 12 hours. This calibration method generates more accurate short-term rainfall estimates. Separate SCaMPR calibrations are performed over ocean and land areas. More information about the quality and calibration methods used on this data product is available at the STAR Satellite Rainfall Estimates SCaMPR web page and in Kuligowski, 2002, Kuligowski, 2010, and Kuligowski et al., 2013.

Software

The data files are in netCDF-4 format. Panoply can be used to easily view these netCDF-4 data files.

Known Issues or Missing Data

There are no known issues with these data or any known gaps in the dataset.

References

Kuligowski, R. J. (2002): A self-calibrating real-time GOES rainfall algorithm for short-term rainfall estimates. *Journal of Hydrometeorology*, 3, 112-130. doi: https://doi.org/10.1175/1525-7541(2002)003%3C0112:ASCRTG%3E2.0.CO;2

Kuligowski, R. J. (2010): Rainfall Rate (QPE) Algorithm Theoretical Basis Document. http://www.goes-r.gov/products/ATBDs/baseline/Hydro_RRQPE_v2.0_no_color.pdf

Kuligowski, R. J., Y. Li, and Y. Zhang (2013): Impact of TRMM data on a low-latency, high-resolution precipitation algorithm for flash flood forecasting. *Journal of Hydrometeorology*, 52, 1379-1393. doi: https://doi.org/10.1175/JAMC-D-12-0107.1

Related Data

All data from other instruments collected during the IPHEx field campaign are related to this dataset. Other IPHEx campaign data can be located using the GHRC HyDRO 2.0 search tool.

Contact Information

To order these data or for further information, please contact:

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